

# WATER WITHDRAWAL AND USE IN MARYLAND, 1987

by Judith C. Wheeler

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MARYLAND GEOLOGICAL SURVEY



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**U.S. DEPARTMENT OF THE INTERIOR**

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## ABSTRACT

This report presents the results of a study by the U.S. Geological Survey, in cooperation with the Maryland Water Resources Administration and the Maryland Geological Survey, to summarize the amounts of fresh and saline water withdrawn and used in Maryland during 1987.

During 1987, about 1,480 million gallons per day (Mgal/d) of freshwater was withdrawn from the surface- and ground-water resources of Maryland. Of this amount, 1,235 Mgal/d (83 percent) was used in the State and 245 Mgal/d (17 percent) was transferred to surrounding States and the District of Columbia, for water supply. About 7.71 Mgal/d of freshwater was imported from bordering States for use in Maryland. In addition, about 6,210 Mgal/d of saline surface water was withdrawn and used in the generation of electricity in Maryland.

The majority of freshwater withdrawals (84 percent) were from surface-water sources. Most fresh surface water was withdrawn and used in the Potomac drainage basin (about 893 Mgal/d), whereas most ground water (about 176 Mgal/d) was withdrawn and used in the Upper Chesapeake drainage basin. The Potomac Group aquifers provided the most ground water (58.5 Mgal/d).

Ten water-use categories comprised the major demands on the surface-water and ground-water resources of the State in 1987:

- Public supply--794 Mgal/d was withdrawn and delivered to residents (for domestic use), commercial establishments, and industries. Public suppliers delivered water to 82 percent of the total population. Baltimore City received the largest public-supply deliveries (150 Mgal/d) in 1987.
- Domestic--493 Mgal/d (426 Mgal/d was received from public suppliers and about 67.3 Mgal/d was self-supplied).
- Commercial--90.6 Mgal/d (about 66.9 Mgal/d was received from public suppliers and 23.8 Mgal/d was self-supplied).
- Industrial--140 Mgal/d (64.6 Mgal/d was received from public suppliers and 75.7 Mgal/d was self-supplied). Industries also used 287 Mgal/d of brackish or saline surface water and about 80.7 Mgal/d of reclaimed sewage water.
- Mining--24.8 Mgal/d of freshwater and about 15.3 Mgal/d of saline surface water was withdrawn. Nearly all the saline water (14.8 Mgal/d) was for dredging operations.
- Thermoelectric power generation--427 Mgal/d of freshwater was withdrawn. In addition, 6,210 Mgal/d of saline surface water was used primarily for cooling condensers.
- Hydroelectric power generation (instream water use)--19,200 Mgal/d of freshwater was used for the production of electricity. Although the amount of water diverted by some plants was considerable, the amount consumed was considered negligible.
- Agricultural (nonirrigation)--10.4 Mgal/d of freshwater was used primarily for livestock watering, feedlots, and dairy operations.
- Irrigation (including irrigating farm crops, golf courses, parks, and nursery plants)--52.4 Mgal/d of freshwater was used. Of this amount, 47.4 Mgal/d was used for irrigating farm crops. In addition, about 5.17 Mgal/d of brackish surface water was used for farm irrigation.
- Aquaculture--6.11 Mgal/d of freshwater was used primarily for raising fish; 5.91 Mgal/d of saline water was used primarily for raising crabs and oysters.

## INTRODUCTION

Maryland has a total land and water area of 12,303 mi<sup>2</sup> (square miles) and is divided into 23 counties and Baltimore City (fig. 1). The State has abundant surface- and ground-water resources. As the demand for water increases, however, stress is placed on these resources. Efficient water-resource management depends, in part, on the collection of water-withdrawal and use data. Once compiled, these data are valuable in determining the effects of present withdrawals on the State's water resources and on current water-use patterns, and in anticipating the effects of future water demands. This study was done in cooperation with the Maryland Water Resources Administration (WRA) and Maryland Geological Survey.

### Purpose and Scope

This report summarizes the amounts of fresh and saline water withdrawn and used in Maryland in 1987. The data are discussed briefly and presented in graphs, tables, and maps, by counties, drainage basins, and aquifers.

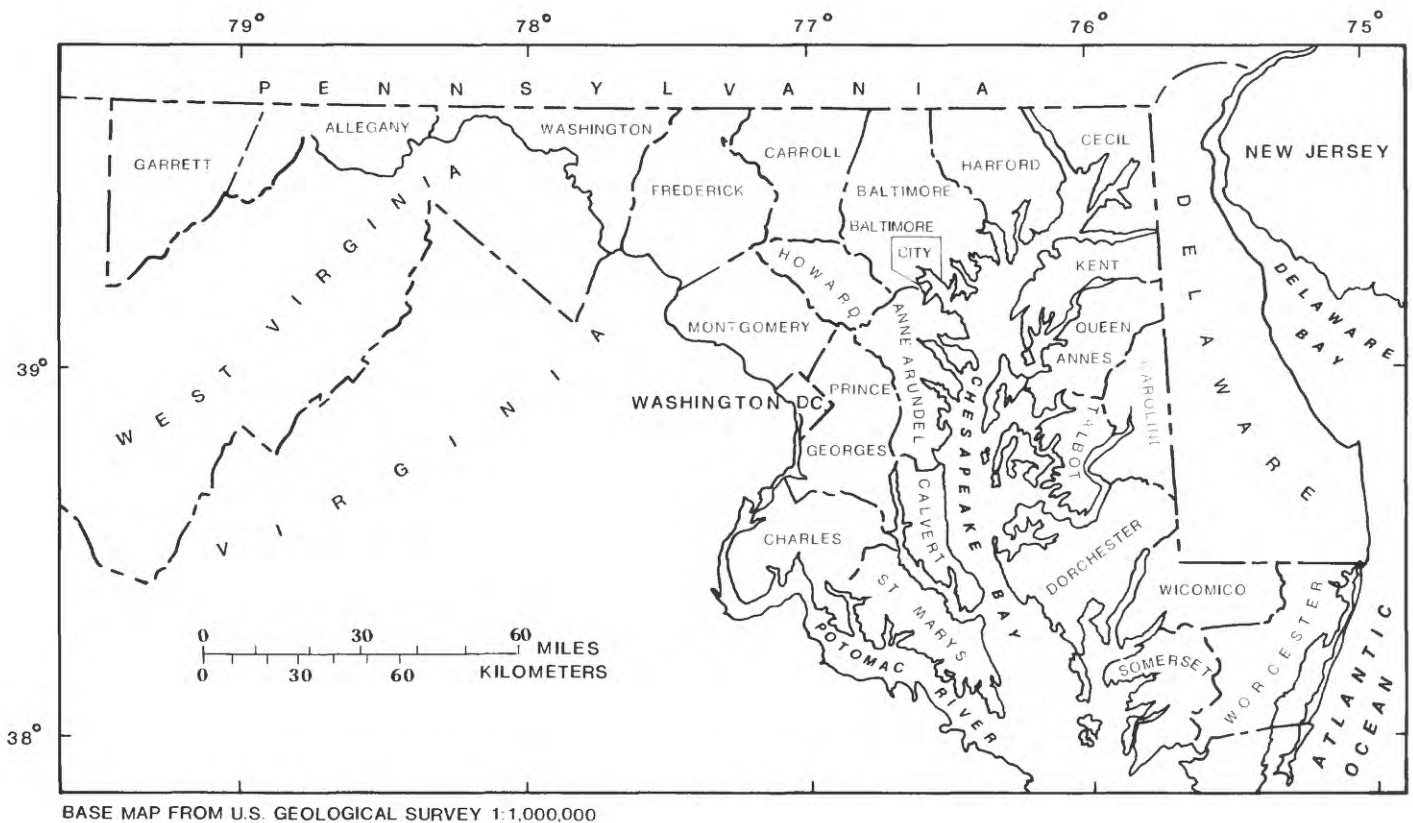


Figure 1.--Counties of Maryland.

The amount of water withdrawn from sources in each county has been distinguished from the amount of water used in each county. Water withdrawals in each county include all water withdrawn or transferred to another county or State. Water use is defined as the amount of water actually used in each county, including (1) water withdrawn for use in the county and (2) water transferred in from another county or State. Self-supplied water and water delivered from public-supply systems are combined for each category.

The water-use categories discussed in this report are public supply, domestic, commercial, industrial, mining, thermoelectric power generation, hydroelectric power generation, agricultural (nonirrigation), irrigation, and aquaculture. Water withdrawn by a public or private water utility and delivered to a variety of users is designated as a "public supply." If a public supply is not available or is not used, the water is classified as "self-supplied." Homes and small communities relying on individual wells are classified as domestic self-supplied water use. Thermoelectric power generation is defined as electric energy generated in steam-electric plants including those that use nuclear fuel. Water used for the generation of electricity by hydroelectric power plants is discussed here but the quantities of water used are not included in the freshwater totals because this use is considered "instream" water use--that is, water use takes place within the stream channel.

### Methods of Data Collection and Estimation

Most of the water-use data on public suppliers, commercial and industrial facilities, mines, and thermoelectric power plants were obtained from pumpage reports submitted to WRA by users withdrawing 0.01 Mgal/d (million gallons per day) or more. Annual and monthly withdrawal data are stored in a computerized data base by WRA. The U.S. Geological Survey, in cooperation with WRA and the Maryland Department of the Environment (MDE), also maintains a site-specific water-use data base, the Maryland State Water-Use Data System (SWUDS) that is designed to store water-withdrawal data from the WRA data base and return-flow data from MDE for users that withdraw or return 0.01 Mgal/d or more. The WRA's data base and SWUDS were used in the preparation of this report. Water-use data for users of less than 0.01 Mgal/d were obtained from the average daily permit allocations as stated in water-appropriation and use permits issued by WRA.

Water-use data on domestic, agriculture, irrigation, and hydroelectric power generation were estimated using the following methods:

Self-supplied domestic withdrawal was estimated by determining the number of people not served by public suppliers (based on data obtained from individual county water and sewerage plans), subtracting that number from the total population for each county (compiled from Maryland Department of State Planning, 1987), and multiplying the result by the estimate of per capita water use. Per capita water use in Maryland was estimated by WRA to be 80 gal/d (gallons per day).

Hydroelectric power generation water use was estimated based on annual generation data (Energy Information Administration, 1987a, 1987b, 1988a, and 1988b) and a coefficient of water used per KWh (kilowatt hour) (Weisberg, S.B., Martin Marietta Environmental Systems, written commun., 1986).

Agricultural (nonirrigation) water use was estimated based on the number of farm animals in each county (U.S. Department of Commerce, 1988) and the amount of water used per animal category (U.S. Environmental Protection Agency, 1973, p. 15). It was assumed that grazing animals such as cattle and sheep relied on surface water for supply, and poultry, hogs, and dairy cows relied on ground water.

Irrigation water use was estimated from the number of acres irrigated, using a water application rate of 0.9 (acre-ft/acre)/yr (acre-foot per acre per year) or about 818 gal/d (Carr, L.E., Maryland Cooperative Extension Service, oral commun., 1989).



## Population and Water-Use Trends

The total population of Maryland was approximately 4,500,000 in 1987 (compiled from Maryland Department of State Planning data, 1987). Population and water-use facts for 1987 are presented in table 1. About 82 percent of the total population (3.68 million people) were served by public-supply systems in 1987. Surface water was used by 67 percent of the population; ground water was used by 33 percent of the population.

Population and water-use trends for Maryland from 1950 to 1987 are shown in figure 2. In 1950, about 2.34 million people used approximately 400 Mgal/d of freshwater. Both population and water use increased steadily through the 1950's and 1960's. From 1970 to 1987, however, the rate of population growth slowed, only increasing from 3.92 million people in 1970 to 4.5 million in 1987. Water use, during the same period, leveled off in the early 1970's at about 1,500 Mgal/d, then decreased over the rest of the decade. In 1980, water use was about 1,400 Mgal/d. Possible explanations for the decrease in water use include changing economic trends, particularly declining water use among certain industries, and increased use of conservation techniques and fixtures. However, water use increased from 1985 to 1987, from about 1,400 Mgal/d to about 1,480 Mgal/d, primarily due to increases in withdrawals for cooling purposes by power plants, for irrigation, and for public-supply distribution.

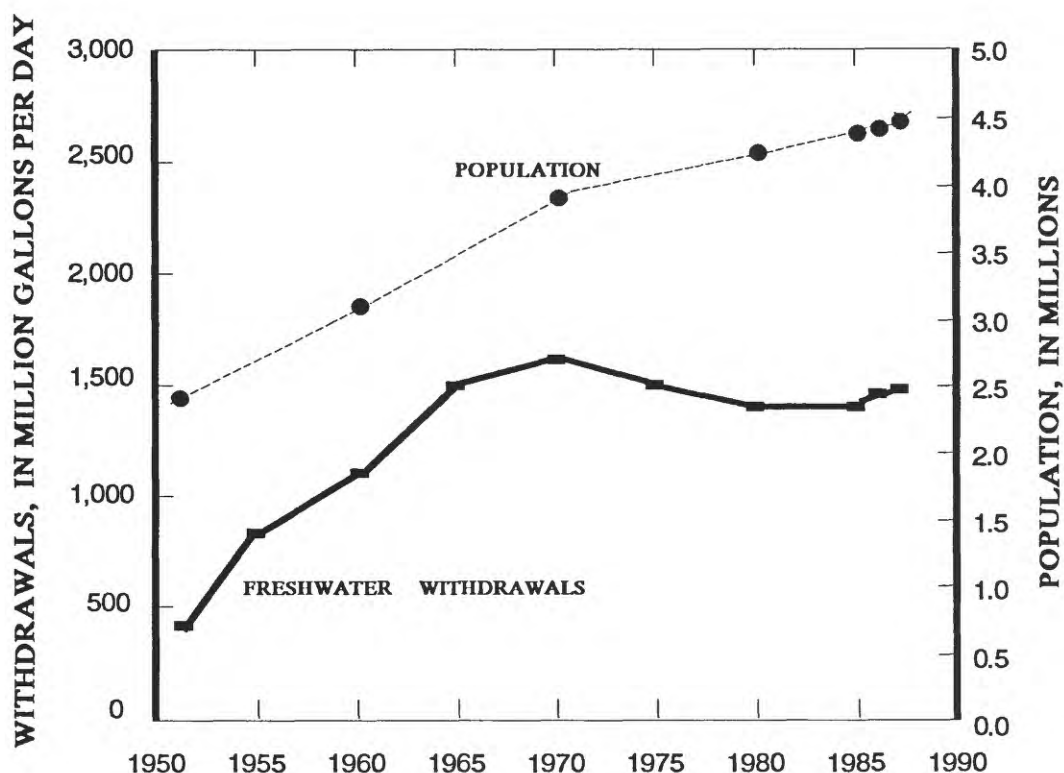


Figure 2.--Population and water-use trends in Maryland, 1950-87.



**Table 1.--Population and water use in Maryland, 1987**

[Population data rounded to three significant figures and may not add to totals because of independent rounding. Percentages rounded to two significant figures]

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Total population:	4,500,000
Population served by public-supply systems	3,680,000
Percentage of population served	82
Population served by self-supplied systems	817,000
Percentage of population self-supplied	18
Surface-water supply:	
Percentage of total population served by surface water	67
Number served by public-supply systems	3,030,000
Percentage of total population	67
Number served by self-supplied systems	0
Percentage of total population	0
Ground-water supply:	
Percentage of total population served by ground water	33
Number served by public-supply systems	651,000
Percentage of total population	15
Number served by self-supplied systems	817,000
Percentage of total population	18

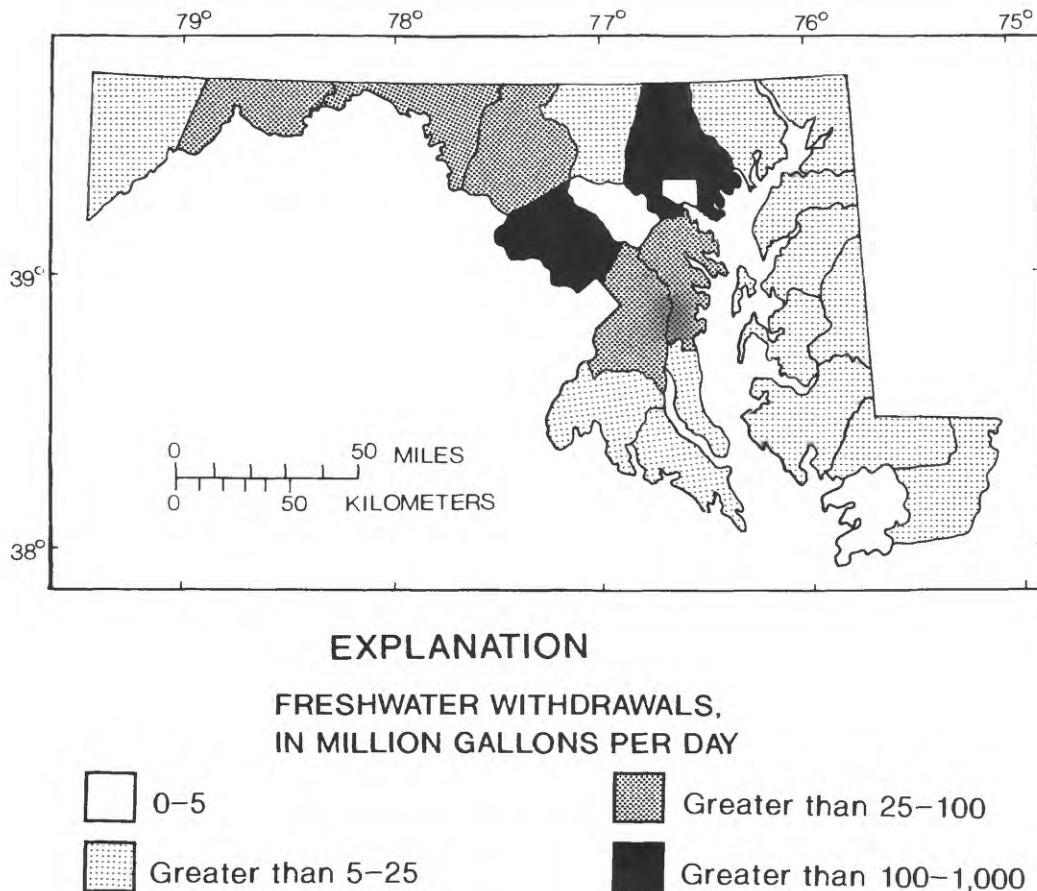
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## WATER WITHDRAWAL AND USE

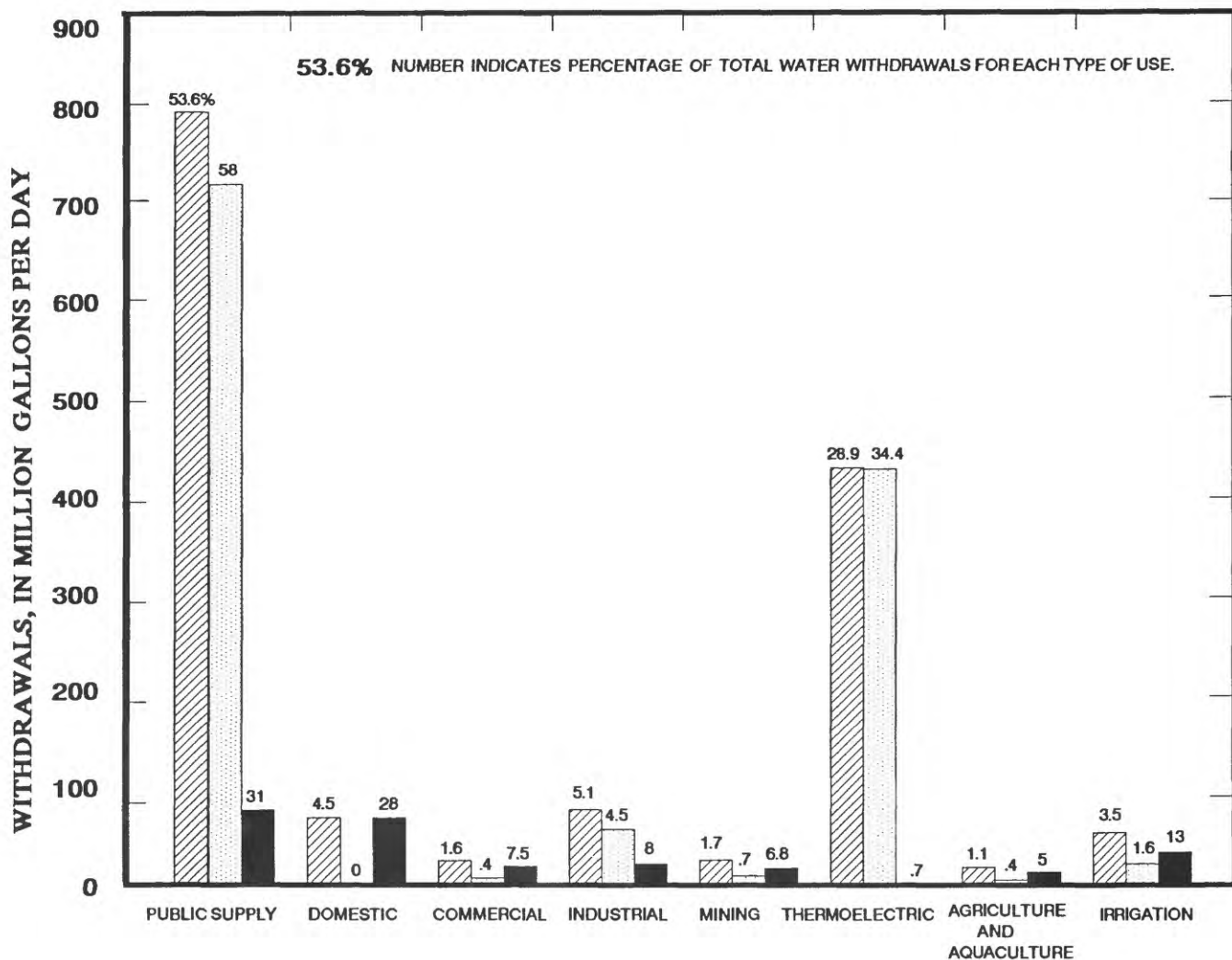
During 1987, approximately 1,480 Mgal/d of freshwater was withdrawn from Maryland's surface- and ground-water sources. Of this amount, 1,235 Mgal/d (83 percent) was used in the State and 245 Mgal/d (17 percent) was transferred to surrounding States and the District of Columbia, for water supply. Conversely, about 7.71 Mgal/d of freshwater was imported from bordering States for use in Maryland.

Freshwater withdrawals by county are shown in figure 3. The largest water withdrawals (greater than 100 Mgal/d) were in Montgomery and Baltimore Counties. These counties provide the water sources for the public suppliers that serve the Baltimore City and District of Columbia metropolitan areas. The smallest water withdrawals were in Baltimore City and Howard County because the main public-supply sources for Baltimore City are located in Baltimore County, and because Howard County is served primarily by the Baltimore City public-supply system and the Washington Suburban Sanitary Commission (WSSC) system (water sources are in Montgomery and Prince Georges Counties).

Freshwater withdrawals by use are summarized in figure 4. Tables 2-12 (located in the appendix at the end of the report) present withdrawal and use data, by county, for the 10 major categories of use. A summary of withdrawals by county is shown in table 2.



**Figure 3.--Freshwater withdrawals in Maryland, by county, 1987.**



#### EXPLANATION




-  TOTAL FRESHWATER WITHDRAWALS.  
TOTAL: 1,480 Million gallons per day
-  FRESH SURFACE-WATER WITHDRAWALS.  
TOTAL: 1,240 Mgal/d.
-  FRESH GROUND-WATER WITHDRAWALS.  
TOTAL: 239 Mgal/d.

Figure 4.--Freshwater withdrawals and percentage for each type of use in Maryland, 1987.

A comparison of total fresh surface- and ground-water withdrawals by county is shown in figure 5. Approximately 84 percent (1,240 Mgal/d) of the freshwater withdrawn in Maryland in 1987 came from surface-water sources compared to 16 percent (239 Mgal/d) from ground-water sources. Most fresh surface-water withdrawals (more than 25 Mgal/d) occurred in Montgomery, Baltimore, Washington, Allegany, and Prince Georges Counties (table 2), whereas most ground-water withdrawals (more than 25 Mgal/d) occurred in Anne Arundel County.

The largest drainage basins in Maryland are the Potomac and the Upper Chesapeake (fig. 6). About 72 percent of total fresh surface-water withdrawals occurred in the Potomac basin. During 1987, about 893 Mgal/d of fresh surface water was withdrawn and used in this basin compared to 339 Mgal/d (about 27 percent) withdrawn and used in the Upper Chesapeake basin. In addition, about 15.3 Mgal/d of fresh surface water was withdrawn in the Potomac basin and transferred to the Chesapeake basin for use; conversely, 36 Mgal/d of fresh surface water was withdrawn in the Upper Chesapeake basin, then transferred to the Potomac basin for use. Less than 1 percent of fresh surface water was withdrawn in the remaining three basins (Monongahela, Susquehanna, and Delaware).

About 74 percent (176 Mgal/d in 1987) of total ground-water withdrawals occurred in the Upper Chesapeake basin compared to about 24 percent (57 Mgal/d in 1987) withdrawn in the Potomac basin. Only about 2 percent of total ground-water withdrawals occurred in the remaining three basins.

Estimated percentages of ground-water withdrawals by principal aquifers for 1987 are shown in figure 7. The map in the figure shows the geographic distribution of the principal aquifers in Maryland (U.S. Geological Survey, 1990, p. 294) with a generalized hydrogeologic section (A-A') of the aquifers most used in the State. The Potomac Group aquifers provided the most ground water, 58.5 Mgal/d (about 24 percent), followed by the Columbia aquifer with 49 Mgal/d (about 21 percent). The least amount of water was withdrawn from the Newark Group aquifers with about 3.3 Mgal/d (less than 2 percent).

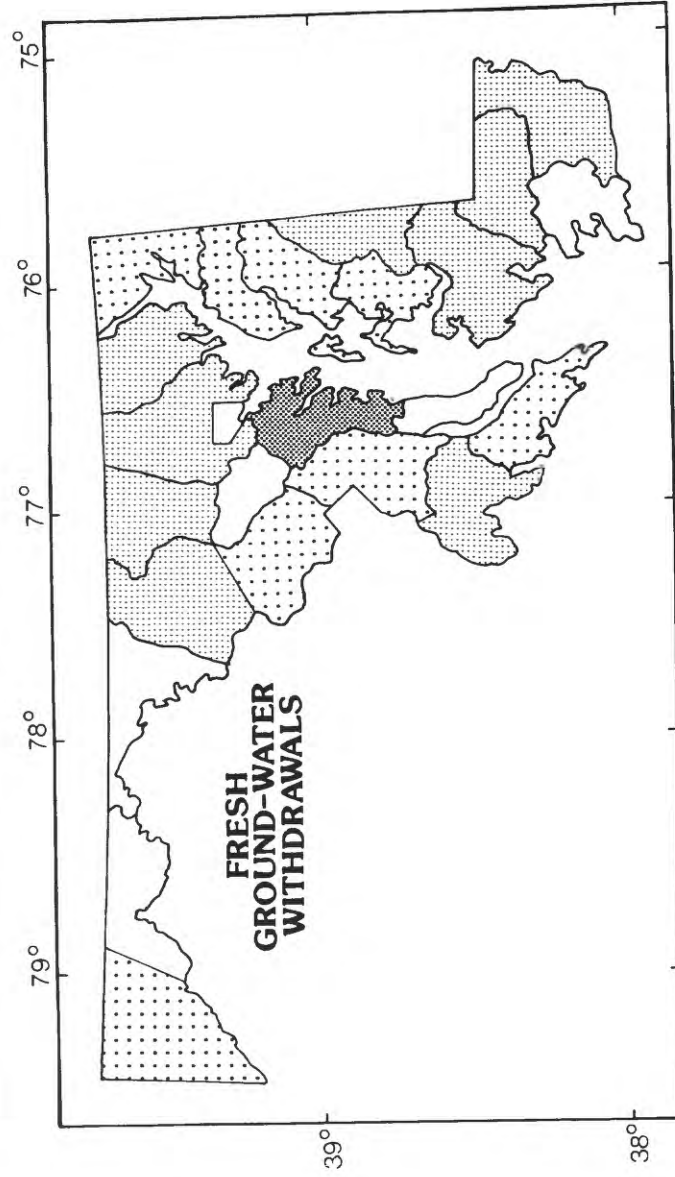
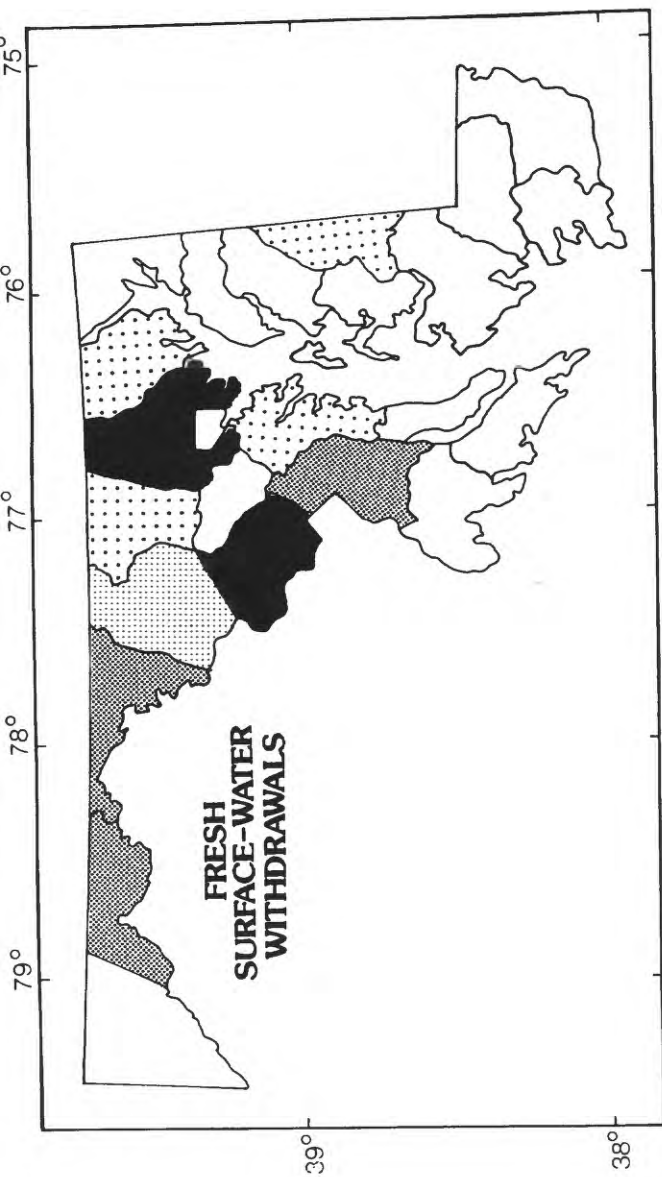
### Public Supply

The largest amount of water withdrawn, 794 Mgal/d (54 percent of total freshwater withdrawals; fig. 4), was by public-supply systems (municipalities, county and town systems, and private utilities). Water was delivered to a variety of users, including residents (domestic use), commercial establishments, and industries (table 3). Most public suppliers in central and western Maryland rely on surface-water sources. The largest user of surface water for public supply in the State is Baltimore City. During 1987, about 150 Mgal/d were withdrawn for use by the city. In addition, the city supplied about 117 Mgal/d to parts of Baltimore, Howard, Anne Arundel, and Carroll Counties. Another large user of surface water for public supply in Maryland is WSSC, which withdrew 168 Mgal/d during 1987 and delivered water to most of Montgomery and Prince Georges Counties and part of Howard County.

The Potomac River in Maryland is used as a source of water by several public suppliers in Virginia and West Virginia and by the Washington Aquaduct, which delivers water to the District of Columbia. In 1987, about 48 Mgal/d of fresh surface water was withdrawn from the river and transferred to these States for use, and nearly 197 Mgal/d was withdrawn for public-supply deliveries to the District.

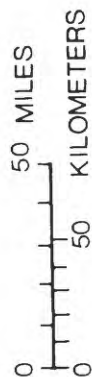
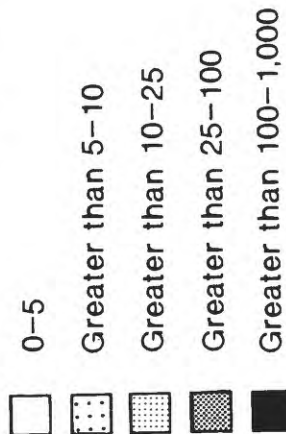
Some municipalities in Maryland obtained all or part of their water supply from bordering States, including Cumberland in Allegany County, which received 7.28 Mgal/d of water from Pennsylvania in 1987; Brunswick in Frederick County, which received about 0.08 Mgal/d from springs located in Virginia; and Delmar in Wicomico County, which received 0.35 Mgal/d from wells located in Delaware.

Most public suppliers that rely on ground-water sources are located in the eastern and southern part of Maryland. The largest ground-water withdrawals for public-supply deliveries are in Anne Arundel County (about 32.1 Mgal/d during 1987). In the counties east of Chesapeake Bay, all public suppliers rely on ground water.



## EXPLANATION

FRESHWATER WITHDRAWALS,  
IN MILLION GALLONS PER DAY



## PERCENTAGE OF TOTAL WITHDRAWALS

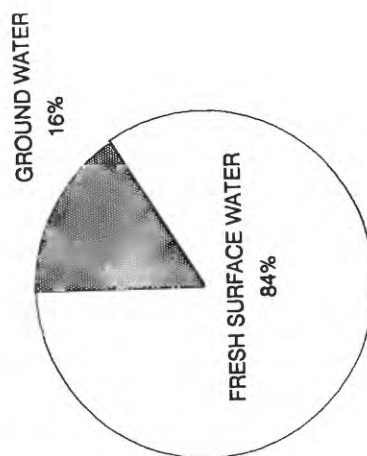
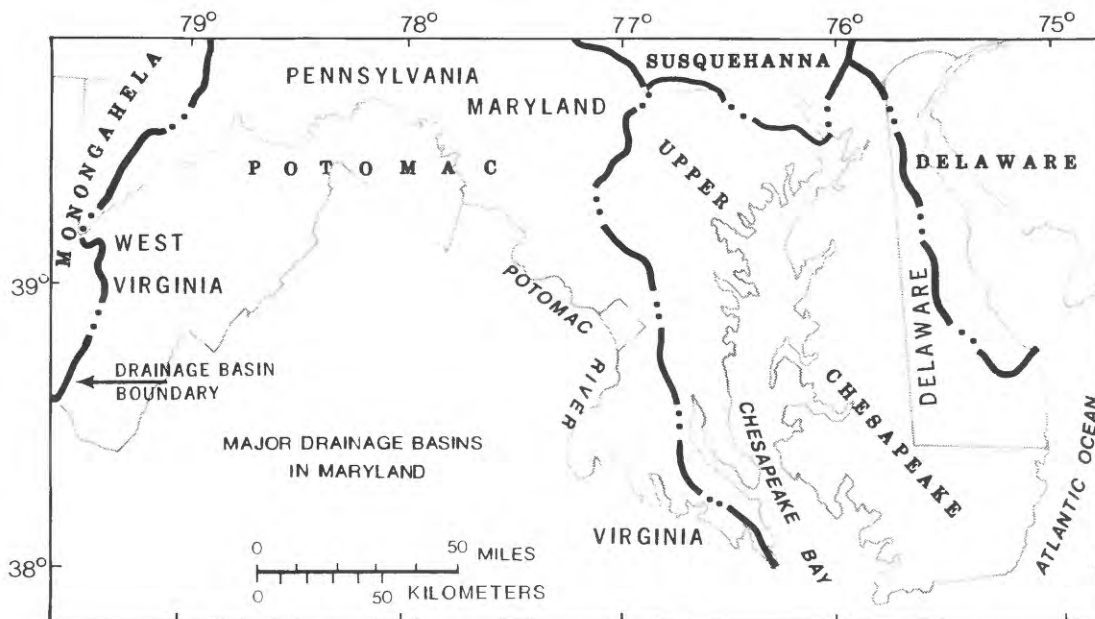
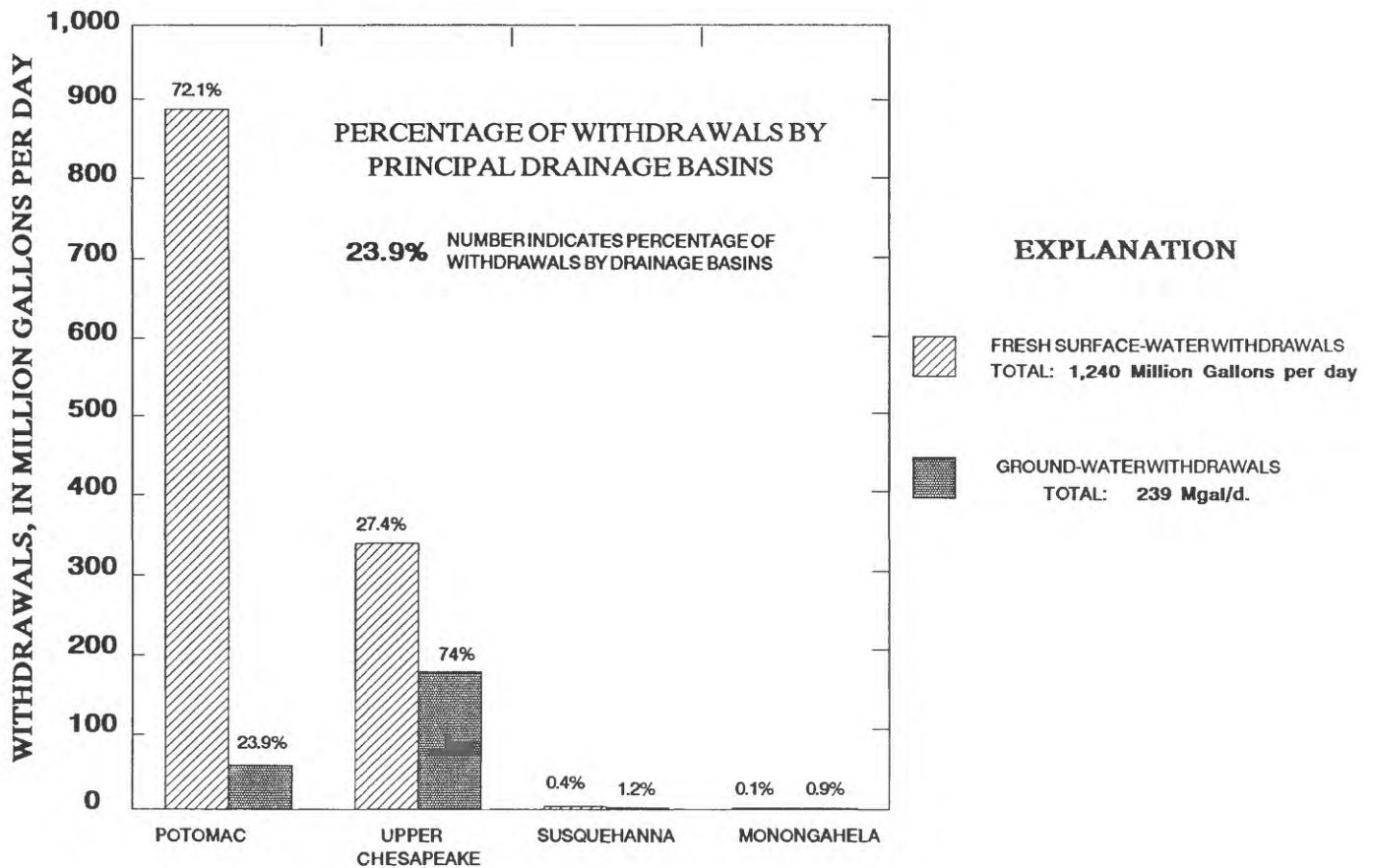


Figure 5.--Fresh surface-water and ground-water withdrawals in Maryland, by county, 1987.



**Figure 6.--Fresh surface-water and ground-water withdrawals by principal drainage basin in Maryland, 1987.**



### Domestic

Domestic water users in Maryland receive water from public-supply systems and from self-supplied sources (table 4). During 1987, total use (withdrawals and deliveries) was 493 Mgal/d, of which 426 Mgal/d was delivered by public suppliers to 82 percent of the total population. The remaining 18 percent of the population withdrew about 67.3 Mgal/d from privately owned wells. The amount of surface water used for domestic purposes was considered to be negligible, therefore all self-supplied water withdrawn for domestic use was assumed to be from ground-water sources.

### Commercial

Commercial water users, including educational institutions and military installations, receive water from public-supply systems and from privately owned wells. Total commercial use during 1987 was 90.6 Mgal/d (table 5), of which about 66.9 Mgal/d (74 percent) was provided by public suppliers and about 23.8 Mgal/d (26 percent) was self-supplied.

### Industrial

Maryland is located within a regional manufacturing belt which extends along the eastern seaboard of the United States. Both heavy and light industries are important in the State's economy. Heavy industries include steel mills, shipyards, petroleum refineries, chemical plants, and truck assembly lines. Some of the prominent light industries include food processing, printing, publishing, and clothing manufacturing. Water used by industries is both self-supplied and received from public-supply systems. Major water uses include washing and separation processes, cooling (industrial machinery and refrigeration), boiler make-up, product manufacturing, and dust control. During 1987, about 140 Mgal/d of freshwater was used by industries in Maryland (table 6). Of that amount, 75.7 Mgal/d or 54 percent was self-supplied and 64.6 Mgal/d (46 percent) was provided by public suppliers. Industries also used 287 Mgal/d of brackish or saline surface water (containing more than 1,000 milligrams per liter of dissolved solids) (Hem, 1970, p. 219) and about 80.7 Mgal/d of reclaimed sewage water.

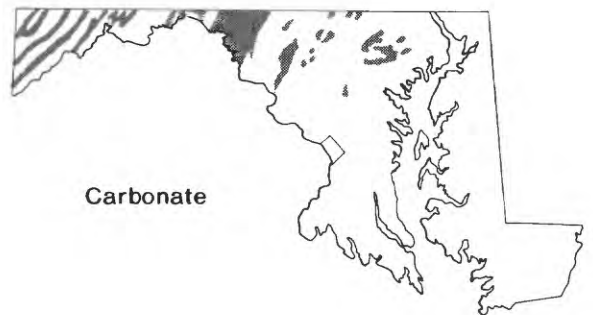
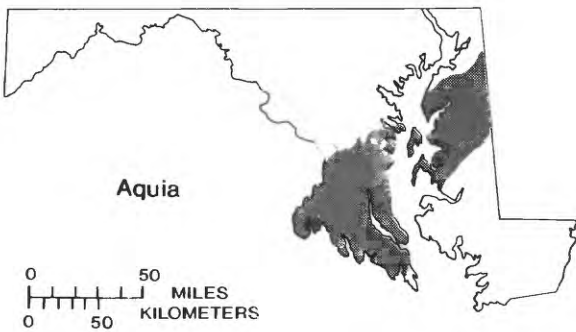
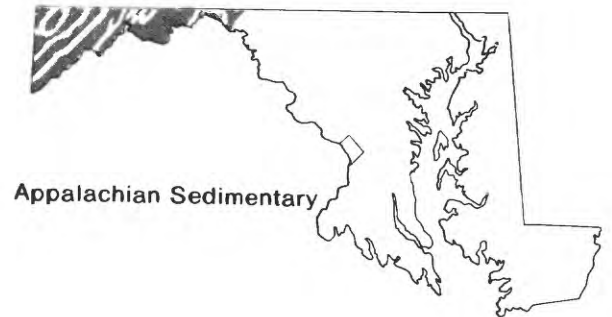
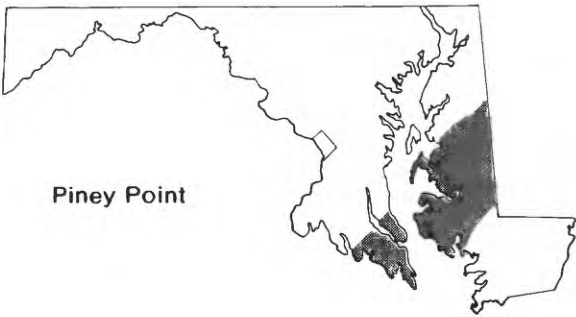
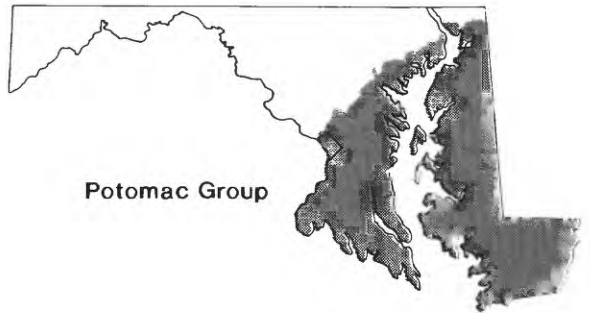
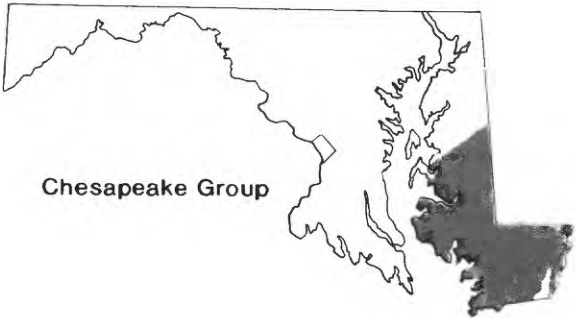
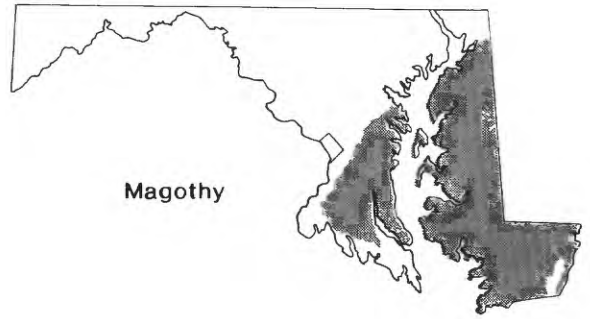
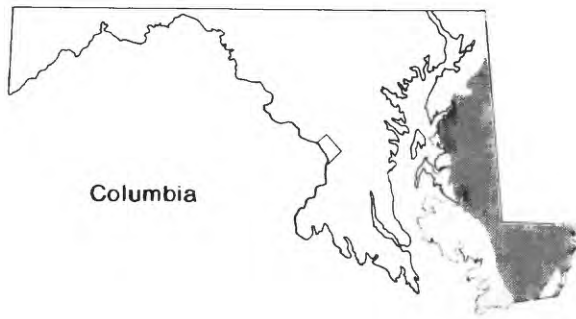
### Mining

Mining is a significant economic activity in Maryland. The commercially important mineral resources extracted are those used for building materials and fuels. The leading commodities are bituminous coal, stone, sand, and gravel. Water withdrawn in mining operations is primarily for dewatering and mineral washing. During 1987, 24.8 Mgal/d of freshwater was withdrawn for mining purposes (table 7). Of that amount, 8.23 Mgal/d was from surface-water sources and 16.5 Mgal/d was from ground-water sources. An additional 15.3 Mgal/d of brackish or saline water was withdrawn, of which 14.8 Mgal/d was for dredging operations.

### Thermoelectric Power Generation

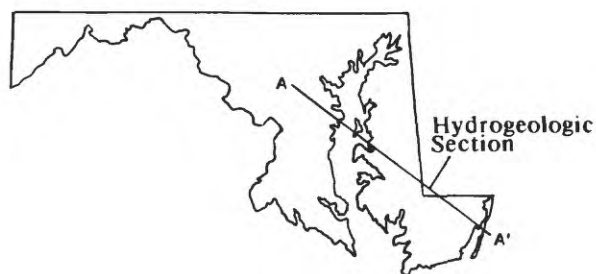
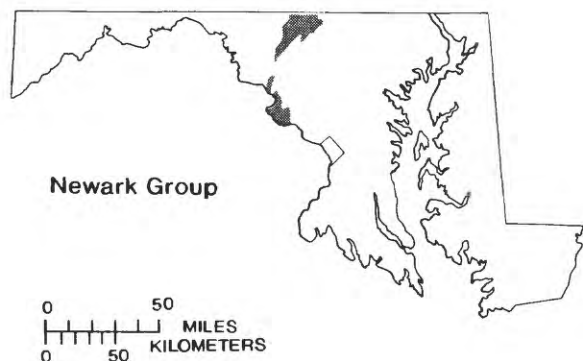
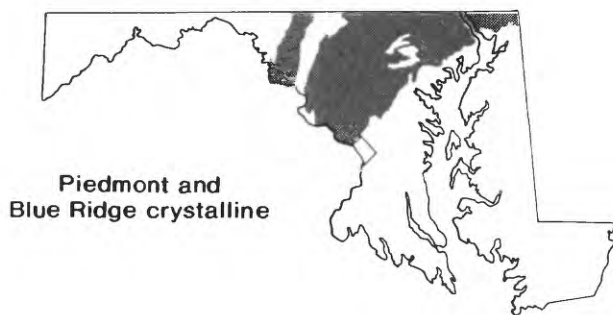
Fourteen thermoelectric power plants operate in Maryland; 13 are fossil-fueled and 1 is nuclear powered. Freshwater use by the plants during 1987 was 427 Mgal/d, of which about 426 Mgal/d was from surface water and 1.6 Mgal/d from ground water (table 8). In addition, 6,210 Mgal/d of saline surface water was used by the plants. Most of the surface water (more than 95 percent) was used for cooling condensers, of which more than 98 percent was returned to the water source.





## AQUIFERS

Figure 7.—Ground-water withdrawals by principal aquifers in Maryland, 1987.



Principal aquifers shown in hydrogeologic section

- Piedmont and Blue Ridge crystalline (1)
- Potomac Group (2)
- Magothy (3)
- Not a principal aquifer (4)
- Aquia (5)
- Piney Point (6)
- Chesapeake Group (7)
- Columbia (8)

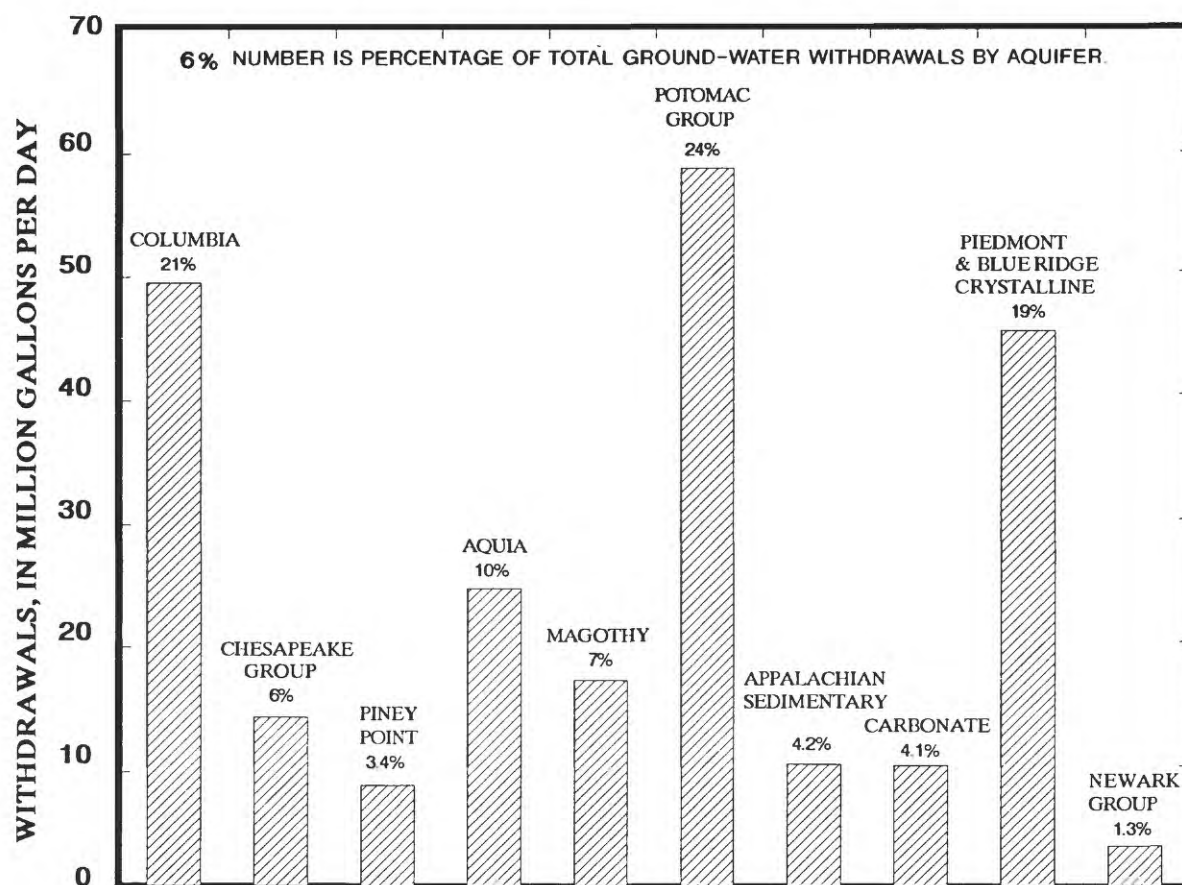
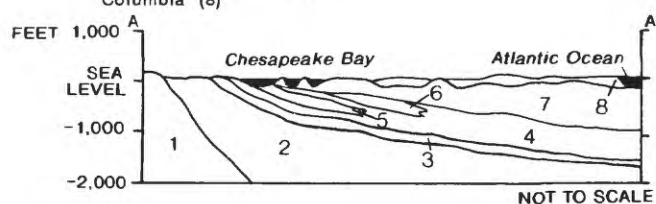


Figure 7.--Ground-water withdrawals by principal aquifers in Maryland, 1987. Continued

### Hydroelectric Power Generation

Water used for the generation of electricity by hydroelectric power plants is discussed here but the quantities of water used are not included in the freshwater totals because this use is considered "instream" water use--that is, water use takes place within the stream channel. Twelve dams are currently producing or are licensed to produce hydroelectric energy in Maryland (Weisberg and Rose, 1985, p. 1). During 1987, about 19,200 Mgal/d of freshwater passed through these plants for the production of electricity (table 9). Although the amount of water diverted by some plants to produce electricity is enormous, the amount consumed is negligible--some water is evaporated during the generation process and from storage reservoirs.

### Agricultural (nonirrigation)

During 1987, about 10.4 Mgal/d of freshwater was used for agricultural (nonirrigation) activities, mainly livestock watering, feedlots, and dairy operations; 2.45 Mgal/d was from surface-water sources and 7.96 Mgal/d from ground-water sources (table 10). The major types of livestock raised in Maryland are poultry, cattle, dairy cows, hogs, and sheep. The four counties (Dorchester, Somerset, Wicomico, and Worcester) of the lower Eastern Shore account for about 34 percent of total agricultural receipts in the State, because this area is one of the nation's leading producers of broiler chickens (Di Lisio, 1983, p. 80).

### Irrigation

Freshwater used for irrigating farm crops, commercial, municipal, and institutional lawns and parks, golf courses, and nursery plants was estimated to be 52.4 Mgal/d in 1987 (table 11). Of this amount, 47.4 Mgal/d was used for irrigating farm crops including corn, soybeans, tobacco, grains, tomatoes, and melons. In addition, 5.17 Mgal/d of brackish surface water was used for farm irrigation. A total of about 64,200 acres of cropland were irrigated in the State in 1987, of which 57,450 acres or about 89 percent were located in the eight counties east of the Chesapeake Bay. Fresh surface water was used to irrigate 23,400 acres (20.1 Mgal/d) and ground water was used to irrigate 34,314 acres (32.3 Mgal/d). Caroline County had the largest percentage of irrigated acreage in the State, with about 29 percent or 2.65 Mgal/d withdrawn for irrigation, followed by Dorchester County with 24 percent or 12.02 Mgal/d.

### Aquaculture

Aquaculture, also known as fish farming or fish culture, is the controlled production of finfish, shellfish, and aquatic plants in fresh and saline environments (Maryland Department of Agriculture, 1988). In Maryland, the aquaculture industry includes ornamental fish, oysters, soft-shell crabs, crawfish, trout, and aquatic plants. During 1987, 6.11 Mgal/d of freshwater was withdrawn for aquacultural purposes in the State, of which 1.84 Mgal/d was from surface-water sources and 4.27 Mgal/d was from ground water (table 12). In addition, 5.91 Mgal/d of saline water was used for this purpose.

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## **APPENDIX**

### **Water-withdrawal and use data**





Table 3.--Public-supply withdrawals and deliveries in Maryland, by county, 1987

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Population served, in thousands			Water withdrawals, in million gallons per day			Water deliveries by type of use, in million gallons per day			Water transfer into or out (-) of county or city
	Source			Source			Domestic Commercial Industrial			
	Surface water	Ground water	Total	Surface water	Ground water	Total	Domestic	Commercial	Industrial	
Allegany	53.54	8.62	62.16	0.45	0.29	0.74	6.07	0.97	3.60	8.90
Anne Arundel	35.53	250.83	286.36	2.53	29.58	32.11	27.19	5.44	3.62	4.14
Baltimore	615.68	1	616.68	267.17	.02	267.19	69.15	14.81	14.82	-168.41
Calvert	.00	10.12	10.12	.00	1.23	1.23	1.11	.12	.00	.00
Caroline	.00	8.84	8.84	.00	1.23	1.23	1.11	.06	.06	.00
Carroll	27.10	16.22	43.32	2.94	1.07	4.01	4.17	.52	.52	1.20
Cecil	16.32	12.81	29.13	1.69	1.33	3.02	2.51	.18	.33	.00
Charles	.00	43.14	43.14	.00	5.58	5.58	5.02	.56	.00	.00
Dorchester	.00	17.74	17.74	.00	3.46	3.46	1.73	.35	1.38	.00
Frederick	44.44	19.48	63.92	9.39	2.29	11.68	9.59	1.20	1.20	.31
Garrett	4.16	3.78	7.94	2.01	.68	2.69	2.76	.10	.09	1.74
Harford	31.02	90.39	121.41	4.41	4.29	8.70	7.40	.87	.43	.00
Howard	127.35	.00	127.35	.00	.00	.00	11.60	1.45	1.45	14.50
Kent	.00	7.43	7.43	.00	.95	.95	.86	.05	.04	.00
Montgomery	608.86	3.84	612.70	381.85	.29	382.14	77.01	9.17	5.50	-290.46
Prince Georges	637	28.28	665.28	35.97	2.83	38.80	66.91	8.36	8.36	44.83
Queen Annes	.00	4.84	4.84	.00	.56	.56	.45	.05	.06	.00
St Marys	.00	23.46	23.46	.00	2.45	2.45	2.33	.12	.00	.00
Somerset	.00	12.67	12.67	.00	1.57	1.57	1.41	.08	.08	.00
Talbot	.00	12.38	12.38	.00	2.05	2.05	1.74	.21	.10	.00
Washington	77.47	7.40	84.87	10.49	.94	11.43	5.44	1.09	4.35	.55
Wicomico	.00	43.54	43.54	.00	5.91	5.91	4.38	.63	1.25	.35
Worcester	.00	24.51	24.51	.00	6.48	6.48	5.18	.97	.32	.01
Baltimore City	751.67	.00	751.67	.00	.00	.00	112.54	19.51	18	150.05
Total	3,030	651	3,680	719	75.1	794	426	66.9	64.6	

**Table 4.--Domestic water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1987**

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Self-supplied				Public-supplied		Total
	Population (self- supplied), in thousands	Water withdrawals, in million gallons per day			Population served, in thousands	Water deliveries, in million gallons per day	With- drawals and deliveries, in million gallons per day
		Source					
		Surface water	Ground water	Total			
Allegany	12.74	0.00	1.00	1.00	62.16	6.07	7.07
Anne Arundel	122.68	.00	10.45	10.45	286.36	27.19	37.64
Baltimore	57.45	.00	4.63	4.63	616.68	69.15	73.78
Calvert	34.11	.00	2.79	2.79	10.12	1.11	3.90
Caroline	15.38	.00	1.28	1.28	8.84	1.11	2.39
Carroll	69.38	.00	5.59	5.59	43.32	4.17	9.76
Cecil	38.28	.00	3.07	3.07	29.13	2.51	5.58
Charles	47.82	.00	3.83	3.83	43.14	5.02	8.85
Dorchester	15.04	.00	1.20	1.20	17.74	1.73	2.93
Frederick	70.02	.00	5.65	5.65	63.92	9.59	15.24
Garrett	18.86	.00	1.51	1.51	7.94	.76	2.27
Harford	37.23	.00	2.98	2.98	121.41	7.40	10.38
Howard	27.96	.00	2.28	2.28	127.35	11.60	13.88
Kent	9.45	.00	.76	.76	7.43	.86	1.62
Montgomery	55.09	.00	4.69	4.69	612.70	77.01	81.70
Prince Georges	24.27	.00	1.96	1.96	665.28	66.91	68.87
Queen Annes	25.58	.00	2.05	2.05	4.84	.45	2.50
St Marys	44.48	.00	3.62	3.62	23.46	2.33	5.95
Somerset	7.60	.00	.61	.61	12.67	1.41	2.02
Talbot	15.31	.00	1.31	1.31	12.38	1.74	3.05
Washington	30.32	.00	2.45	2.45	84.87	5.44	7.89
Wicomico	26.46	.00	2.48	2.48	43.54	4.38	6.86
Worcester	11.67	.00	1.08	1.08	24.51	5.18	6.26
Baltimore City	.00	.00	.00	.00	751.67	112.54	112.54
Total	817	0.00	67.3	67.3	3,680	426	493

**Table 5.--Commercial freshwater withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1987**

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Self-supplied		Total	Public-supplied	Total
	Water withdrawals, in million gallons per day			Water deliveries, in million gallons per day	Withdrawals and deliveries, in million gallons per day
	Source				
	Surface water	Ground water			
Allegany	0.02	0.16	0.18	0.97	1.15
Anne Arundel	.32	6.31	6.63	5.44	12.07
Baltimore	.06	.59	.65	14.81	15.46
Calvert	.02	.41	.43	.12	.55
Caroline	.00	.22	.22	.06	.28
Carroll	.44	.47	.91	.52	1.43
Cecil	.23	.48	.71	.18	.89
Charles	.00	1.90	1.90	.56	2.46
Dorchester	.00	.13	.13	.35	.48
Frederick	.04	.91	.95	1.20	2.15
Garrett	.32	.41	.73	.10	.83
Harford	3.95	.46	4.41	.87	5.28
Howard	.06	.33	.39	1.45	1.84
Kent	.00	.13	.13	.05	.18
Montgomery	.00	.40	.40	9.17	9.57
Prince Georges	.01	1.48	1.49	8.36	9.85
Queen Annes	.00	.43	.43	.05	.48
St Marys	.00	1.54	1.54	.12	1.66
Somerset	.00	.21	.21	.08	.29
Talbot	.00	.29	.29	.21	.50
Washington	.06	.11	.17	1.09	1.26
Wicomico	.00	.47	.47	.63	1.10
Worcester	.00	.40	.40	.97	1.37
Baltimore City	.00	.00	.00	19.51	19.51
Total	5.53	18.2	23.8	66.9	90.6

**Table 6.--Industrial water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1987**

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Self-supplied withdrawals, in million gallons per day								Public- supplied deliveries of freshwater, in million gallons per day	Total withdrawals and deliveries of freshwater, in million gallons per day
	Source					Total, excluding reclaimed sewage				
	Surface water		Ground water		Re- claimed sewage					
	Fresh	Saline	Fresh	Saline		Fresh	Saline	Total		
Allegany	49.28	0.00	0.02	0.00	0.00	49.30	0.00	49.30	2.60	51.90
Anne Arundel	.00	.01	3.16	.00	.00	3.16	.01	3.17	3.62	6.78
Baltimore	.28	273.38	4.20	.00	80.70	4.48	273.38	277.86	14.82	19.30
Calvert	.00	.00	.02	.00	.00	.02	.00	.02	.00	.02
Caroline	.00	.00	.45	.00	.00	.45	.00	.45	.06	.51
Carroll	2.01	.00	.06	.00	.00	2.07	.00	2.07	.52	2.59
Cecil	.55	.00	.04	.00	.00	.59	.00	.59	.33	.92
Charles	.01	.00	.00	.00	.00	.01	.00	.01	.00	.01
Dorchester	.00	.40	.92	.00	.00	.92	.40	1.32	1.38	2.30
Frederick	.00	.00	.28	.00	.00	.28	.00	.28	1.20	1.48
Garrett	.35	.00	.03	.00	.00	.38	.00	.38	.09	.47
Harford	.03	.00	.16	.00	.00	.19	.00	.19	.43	.62
Howard	.24	.00	.04	.00	.00	.28	.00	.28	1.45	1.73
Kent	.00	.00	.37	.00	.00	.37	.00	.37	.04	.41
Montgomery	.02	.00	.03	.00	.00	.05	.00	.05	5.50	5.55
Prince Georges	.00	.00	.02	.00	.00	.02	.00	.02	8.36	8.38
Queen Anne	.01	.00	.27	.00	.00	.28	.00	.28	.06	.34
St Marys	.01	.00	.04	.00	.00	.05	.00	.05	.00	.05
Somerset	.00	.00	.11	.00	.00	.11	.00	.11	.08	.19
Talbot	.00	.00	.58	.00	.00	.58	.00	.58	.10	.68
Washington	2.96	.00	.01	.00	.00	2.97	.00	2.97	4.35	7.32
Wicomico	.00	.00	2.99	.00	.00	2.99	.00	2.99	1.25	4.24
Worcester	.00	.00	1.76	.00	.00	1.76	.00	1.76	.32	2.08
Baltimore City	.00	13.29	4.36	.00	.00	4.36	13.29	17.65	18.00	22.36
Total	55.8	287	19.9	0.00	80.7	75.7	287	363	64.6	140

**Table 7.—Mining water withdrawals in Maryland, by county, 1987**

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Water withdrawals, in million gallons per day								
	Source						Total		
	Surface water		Total	Ground water		Total	Fresh	Saline	Total
	Fresh	Saline		Fresh	Saline				
Allegany	0.02	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.02
Anne Arundel	2.23	.00	2.23	.06	.00	.06	2.29	.00	2.29
Baltimore	.63	14.78	15.41	3.46	.00	3.46	4.09	14.78	18.87
Calvert	.00	.00	.00	.00	.00	.00	.00	.00	.00
Caroline	.00	.00	.00	.00	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	4.76	.00	4.76	4.76	.00	4.76
Cecil	.42	.00	.42	.18	.00	.18	.60	.00	.60
Charles	.11	.00	.11	.91	.00	.91	1.02	.00	1.02
Dorchester	.89	.00	.89	.00	.00	.00	.89	.00	.89
Frederick	.04	.00	.04	4.10	.00	4.10	4.14	.00	4.14
Garrett	.41	.00	.41	2.15	.00	2.15	2.56	.00	2.56
Harford	.03	.00	.03	.33	.00	.33	.36	.00	.36
Howard	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00	.00	.00	.00	.00
Montgomery	.10	.00	.10	.20	.00	.20	.30	.00	.30
Prince Georges	3.10	.00	3.10	.07	.00	.07	3.17	.00	3.17
Queen Annes	.00	.00	.00	.00	.00	.00	.00	.00	.00
St Marys	.25	.00	.25	.03	.00	.03	.28	.00	.28
Somerset	.00	.00	.00	.00	.00	.00	.00	.00	.00
Talbot	.00	.00	.00	.00	.00	.00	.00	.00	.00
Washington	.00	.00	.00	.26	.00	.26	.26	.00	.26
Wicomico	.00	.00	.00	.01	.00	.01	.01	.00	.01
Worcester	.00	.47	.47	.01	.00	.01	.01	.47	.48
Baltimore City	.00	.01	.01	.00	.00	.00	.00	.01	.01
Total	8.23	15.3	23.5	16.5	0.00	16.5	24.8	15.3	40.0

**Table 8.--Thermoelectric power generation water withdrawals in Maryland, by county, 1987**

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Water withdrawals, in million gallons per day				
	Source			Fresh ground water	Total freshwater withdrawals
	Surface Water				
	Fresh	Saline	Total		
Allegany	0.00	0.00	0.00	0.00	0.00
Anne Arundel	.00	899.60	899.60	.00	.00
Baltimore	.00	492.06	492.06	.00	.00
Calvert	.00	2846.33	2846.33	.32	.32
Caroline	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	.00	.00
Cecil	.00	.00	.00	.00	.00
Charles	.00	1341.37	1341.37	.52	.52
Dorchester	.00	1.17	1.17	.03	.03
Frederick	.00	.00	.00	.00	.00
Garrett	.00	.00	.00	.00	.00
Harford	.00	.00	.00	.00	.00
Howard	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00
Montgomery	379.04	.00	379.04	.00	379.04
Prince Georges	.00	516.64	516.64	.73	.73
Queen Annes	.00	.00	.00	.00	.00
St Marys	.00	.00	.00	.00	.00
Somerset	.00	.00	.00	.00	.00
Talbot	.00	.00	.00	.00	.00
Washington	46.64	.00	46.64	.00	46.64
Wicomico	.00	.00	.00	.00	.00
Worcester	.00	.00	.00	.00	.00
Baltimore City	.00	113.38	113.38	.00	.00
Total	426	6,210	6,640	1.60	427

**Table 9.--Hydroelectric power generation water use in Maryland, by county, 1987**

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Water use	
	Million gallons per day	Thousand acre-feet per year
Allegany	0.00	0.00
Anne Arundel	.00	.00
Baltimore	.00	.00
Calvert	.00	.00
Caroline	.00	.00
Carroll	.00	.00
Cecil	7.73	8.67
Charles	.00	.00
Dorchester	.00	.00
Frederick	.00	.00
Garrett	60.84	68.20
Harford	17,950.68	20,122.71
Howard	.00	.00
Kent	.00	.00
Montgomery	.00	.00
Prince Georges	.00	.00
Queen Annes	.00	.00
St Marys	.00	.00
Somerset	.00	.00
Talbot	.00	.00
Washington	1228.53	1377.18
Wicomico	.00	.00
Worcester	.00	.00
Baltimore City	.00	.00
<b>Total</b>	<b>19,200</b>	<b>21,600</b>



**Table 10.—Agricultural (nonirrigation) water withdrawals in Maryland, by county, 1987**

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Water withdrawals, in million gallons per day		
	Source		Total
	Surface water	Ground water	
Allegany	0.06	0.02	0.08
Anne Arundel	.04	.03	.07
Baltimore	.13	.16	.29
Calvert	.02	.00	.02
Caroline	.04	.28	.32
Carroll	.31	.46	.77
Cecil	.10	.20	.30
Charles	.04	.04	.08
Dorchester	.01	.19	.20
Frederick	.48	1.40	1.88
Garrett	.22	.24	.46
Harford	.17	.21	.38
Howard	.10	.08	.18
Kent	.06	.21	.27
Montgomery	.11	.14	.25
Prince Georges	.04	.02	.06
Queen Annes	.06	.22	.28
St Marys	.05	.08	.13
Somerset	.02	.79	.81
Talbot	.03	.18	.21
Washington	.31	.71	1.02
Wicomico	.02	1.15	1.17
Worcester	.03	1.15	1.18
Baltimore City	.00	.00	.00
Total	2.45	7.96	10.4

**Table 11.--Irrigation water withdrawals in Maryland, by county, 1987**

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Water withdrawals							
	Irrigated land by type, in thousand acres		Thousand acre-feet per year			Million gallons per day		
			Source		Total	Source		Total
			Spray	Flood		Surface	Ground	
Allegany	0.12	0.00	0.40	0.00	0.40	0.36	0.00	0.36
Anne Arundel	.15	.00	.65	.12	.77	.58	.11	.69
Baltimore	.93	.00	.93	.19	1.12	.83	.17	1.00
Calvert	.56	.00	.46	.09	.55	.41	.08	.49
Caroline	18.63	.00	5.68	8.50	14.18	5.07	7.58	12.65
Carroll	.51	.00	.41	.07	.48	.37	.06	.43
Cecil	.32	.00	.26	.11	.37	.23	.10	.33
Charles	.98	.00	.83	.08	.91	.74	.07	.81
Dorchester	15.59	.00	2.67	10.81	13.47	2.38	9.64	12.02
Frederick	.28	.00	.31	.02	.34	.28	.02	.30
Garrett	.30	.00	.31	.00	.31	.28	.00	.28
Harford	.75	.00	.55	.15	.70	.49	.13	.62
Howard	.16	.00	.11	.03	.15	.10	.03	.13
Kent	2.50	.00	.06	4.27	4.33	.05	3.81	3.86
Montgomery	.39	.00	.66	.21	.87	.59	.19	.78
Prince Georges	.33	.00	.55	.13	.68	.49	.12	.61
Queen Annes	9.62	.00	4.34	3.69	8.03	3.87	3.29	7.16
St Marys	.84	.00	.58	.02	.61	.52	.02	.54
Somerset	1.58	.00	.28	1.12	1.40	.25	1.00	1.25
Talbot	1.86	.00	1.00	.99	1.98	.89	.88	1.77
Washington	.07	.00	.04	.02	.07	.04	.02	.06
Wicomico	5.26	.00	1.11	3.15	4.26	.99	2.81	3.80
Worcester	2.47	.00	.37	2.40	2.77	.33	2.14	2.47
Baltimore City	.00	.00	.00	.00	.00	.00	.00	.00
Total	64.2	0.00	22.6	36.2	58.8	20.1	32.3	52.4

**Table 12.--Aquaculture water withdrawals in Maryland, by county, 1987**

[Total amounts at bottom of table are rounded to three significant figures]

County or city	Water withdrawals, in million gallons per day				
	Source			Fresh ground water	Total freshwater withdrawals
	Surface water				
	Fresh	Saline	Total		
Allegany	0.01	0.00	0.01	0.00	0.01
Anne Arundel	.00	.00	.00	.01	.01
Baltimore	.00	4.06	4.06	.00	.00
Calvert	.00	.002	.002	.00	.00
Caroline	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	.00	.00
Cecil	.00	.00	.00	.00	.00
Charles	.00	.00	.00	.00	.00
Dorchester	.00	.002	.002	.00	.00
Frederick	1.53	.00	1.53	.00	1.53
Garrett	.30	.00	.30	.00	.30
Harford	.00	.00	.00	.00	.00
Howard	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00
Montgomery	.00	.00	.00	.00	.00
Prince Georges	.00	.00	.00	.00	.00
Queen Annes	.00	.00	.00	.00	.00
St Marys	.00	1.60	1.60	.00	.00
Somerset	.00	.25	.25	.00	.00
Talbot	.00	.00	.00	.00	.00
Washington	.00	.00	.00	4.26	4.26
Wicomico	.00	.00	.00	.00	.00
Worcester	.00	.00	.00	.00	.00
Baltimore City	.00	.00	.00	.00	.00
Total	1.84	5.91	7.75	4.27	6.11